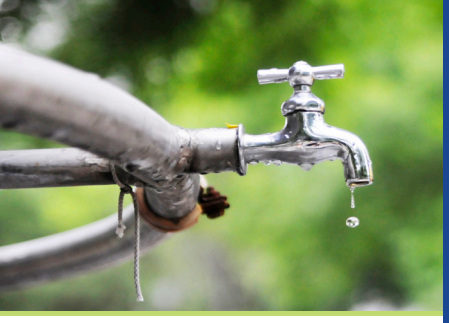
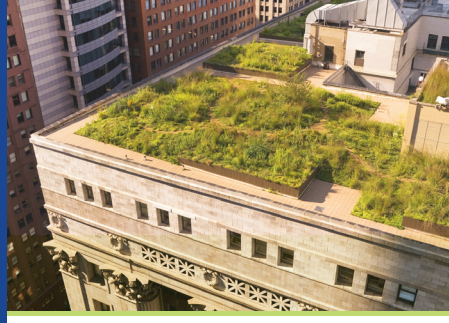


GREATER LAKES

Reconnecting the Great Lakes Water Cycle



Municipalities Helping to Reconnect the Great Lakes Water Cycle

Greater Lakes Project | June 2015

Sustainable management of human activity in the Great Lakes and St. Lawrence River system is critical to protect and restore significant ecosystems, maintain the economic health and vitality of the region, and ensure the livelihood of the millions of people who live in the region. Challenges continue to threaten the quality and quantity of this freshwater treasure, including a broken water system characterized by aging water and wastewater infrastructure, a legacy of poor land use planning, wasteful behaviors toward water use, and a siloed approach to the management of water in many municipalities.

Municipalities are on the frontlines when it comes to the Great Lakes and St. Lawrence River, and are uniquely positioned to have a positive effect on this ecosystem through a shift in their approach to water management.

The project focuses on six communities:

Lyon Township, Michigan
Southwest Oakland Township, Michigan
Commerce Township, Michigan
City of Guelph, Ontario
City of Waterloo, Ontario
Region of Waterloo, Ontario

The Greater Lakes: Reconnecting the Great Lakes Water Cycle project, supported by the Great Lakes Protection Fund, is exploring and testing environmental and financial rationales for municipalities to adopt water conservation/efficiency and green infrastructure measures. The project focuses on six communities: Lyon, Southwest Oakland, and Commerce townships in Michigan; and the cities of Guelph and Waterloo and the Region of Waterloo in Ontario (visit http://glc.org/files/projects/greaterlakes/GreaterLakes-About-Factsheet-2015-March.pdf to learn more).

This fact sheet provides an overview of key lessons learned thus far from the project. We are confident that these will be useful for all municipalities and concerned citizens to evaluate how water is managed in their communities and to work toward improvements. Perhaps the most significant take-away from the project is that we must develop a more integrated, holistic approach to water management in order to restore the water system to a more natural condition that will better serve both human needs and the needs of wildlife and other parts of our ecosystem.

By quantifying the full range of environmental benefits and financial outcomes, and employing innovative knowledge transfer strategies, we will be able to encourage support from key decision-makers and community leaders for innovation in water management both at the water withdrawal and use stage and at the sewage disposal and stormwater management stages.

We need to rethink the water system

The current approach to water in many municipalities does not recognize how the disruption of the natural water cycle through our withdrawal and piping systems has many negative consequences. The following are examples of the negative impacts of this disrupted water cycle on both the local environment and on our urban communities:

1. **Contamination of the quality of the receiving waters**
2. **Lower groundwater levels, which may affect the water supply for municipalities and farm operations**
3. **Pumping in deeper groundwater wells, which increases pumping costs**
4. **Increased energy use and costs to pump and distribute water**
5. **Reduced levels and flows in streams with disruption of habitat**
6. **Flash floods that cause major disruption in urban areas**
7. **Sudden large discharges of water into streams and rivers, which cause erosion problems**
8. **High capital expenditures on water infrastructure to increase capacity or repair/replace overused systems**

Water conservation/efficiency and green infrastructure best practices can help reduce negative impacts of water uses and withdrawals, and of storm and waste water discharges. This will lead to more sustainable management of our essential freshwater systems. The key for decisionmakers throughout the region is to place confidence in the ability of water conservation/efficiency and green infrastructure measures to help complement existing gray infrastructure and defer or substantially reduce large capital projects aimed at increasing capacity or repairing worn out systems. Many municipalities in the region are already making significant steps along this path.

An excellent example of how water conservation measures can help defer capital infrastructure projects is from Waterloo, Ontario. Despite a growing population, as a result of a focus on water efficiency measures, the Region of Waterloo has deferred $100 million in water-related capital expenditures to date and is likely to be able to avoid a $1 billion pipeline project to Lake Erie that officials thought was going to be essential to increase drinking water supply. To learn more about Waterloo's water efficiency measures, please visit www.glc.org/projects/water-resources/greater-lakes.

Using regional rainfall data, ECT calculated that a one-mile long piece of road that is 24 feet wide diverts approximately 65,000 gallons of water in a one-inch rain through pipes or hardened ditches to distant streams. This translates to between one million and 1.5 million gallons of water per road mile per year.

The benefits of green infrastructure on our water resources and the environment are evident in an analysis that Environmental Consulting and Technology (ECT) carried out for the Greater Lakes project. ECT developed a tool to compare the potential retention capacity available in various green infrastructure measures on a per-acre-of-BMP-implemented basis.

The Storage Capacity of Different BMPs

Management Practice	Proposed Area	Area (square feet)	Volume Captured (cubic feet)	Volume Captured (gallons)
Urban Reforestation	1.00	43,560	489	3,659
Forest Retention	1.00	43,560	6,850	51,932
Wet Meadow	1.00	43,560	43,560	325,872
Native Prairie	1.00	43,560	339	2,539
Agriculture	1.00	43,560	339	339
Rain garden	0.01	218	1,234	9,233
Bioswales	20.00	linear feet	420	3,142
	0.01	420		

Table 1. Note: These estimates are for scoping and comparison purposes only. Prepared by Environmental Consulting and Technology.

In our work, it has become evident that many municipalities are operating within a broken or partially broken water system. Our water supply, wastewater and stormwater management processes have fractured the natural water system through a focus on piped conveyance that moves water unnaturally over great distances. An integrated approach to water management, one in which all water operations in a municipality are considered part of one system, will help us restore some of the natural water cycle and more sustainably manage our freshwater resources. A focus on both water conservation/efficiency and green infrastructure programs will be necessary for success.

The water/energy nexus is real

Pumping, treating and distributing water over long distances, and then treating wastewater and piping it away, results in higher energy use and costs for municipalities as well as greater greenhouse gas (GHG) emissions than in systems with aggressive water conservation/efficiency and green infrastructure systems. Work for this project by the Alliance for Water Efficiency (AWE) shows this. In Lyon Township, Michigan, which is groundwater dependent, there is increased drawdown of the groundwater sources during the summer as a result of more watering for outdoor purposes. As summer goes on, water is pumped from deeper and deeper levels and more energy is used by the utility. AWE's work showed that enlisting water conservation measures can help reduce the drawdown by wells and reduce energy needs for pumping.

Further evidence of the water/energy connection can be seen when analyzing electricity savings and GHG emission reductions associated with water conservation, as illustrated in part of the AWE cost/benefit analysis of water conservation measures. The detailed analysis is available on the Greater Lakes project website at http://glc.org/projects/water-resources/greater-lakes/greater-lakes-resources.

The first graph demonstrates the annual and cumulative electricity savings over a 20-year period for the Region of Waterloo if particular water conservation measures are implemented (Figure 1). Similarly, the analysis of water conservation measures in the city of Guelph, Ontario, resulted in the following representation of cumulative GHG emission reductions (Figure 2). This piece of AWE's analysis illustrates the connection between water conservation and emission reductions and operating cost savings.

Waterloo Region Annual and Cumulative Electricity Savings

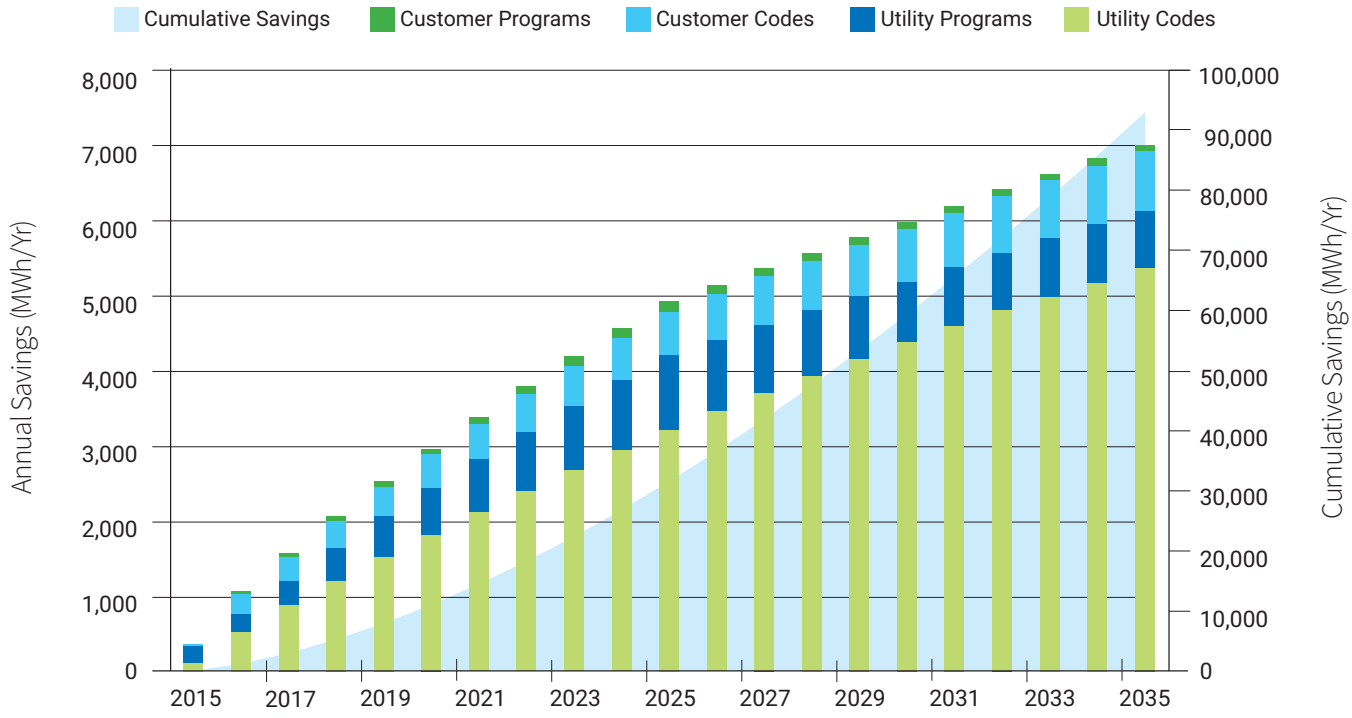


Figure 1. Prepared by the Alliance for Water Efficiency

Cumulative CO_2 Emission Reductions

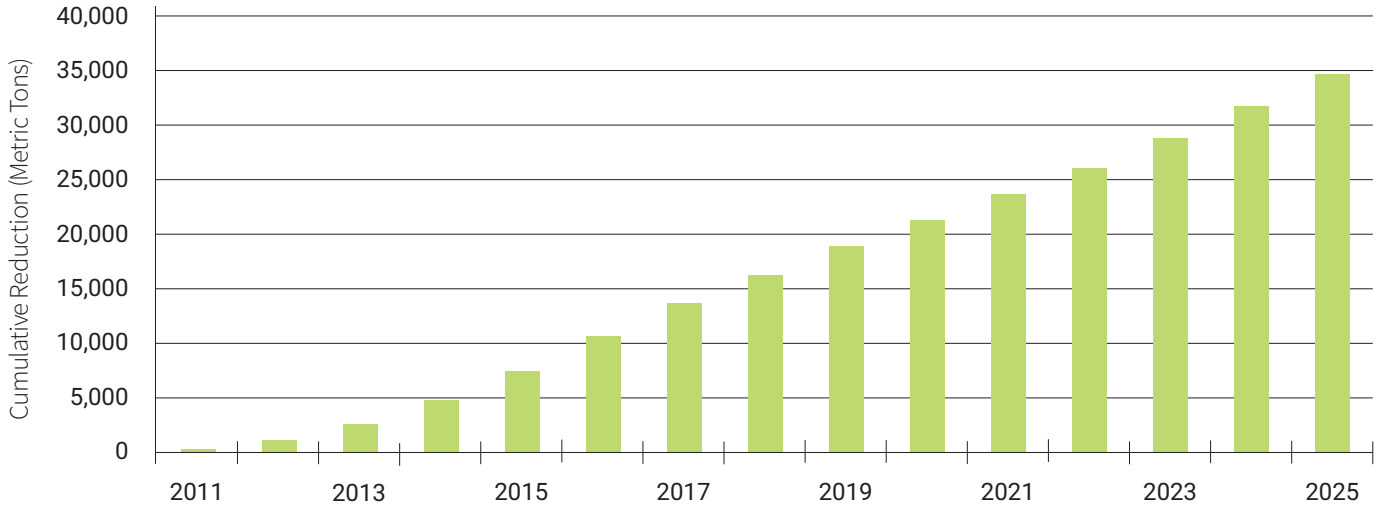


Figure 2. Prepared by the Alliance for the Water Efficiency

When considering water conservation measures to implement, it is critical that municipalities take into account, among other things, energy and GHG emissions impacts. An understanding of the water/energy nexus can help lead to more impactful and often times more economically beneficial decisions about how a municipality uses water conservation in their water management approach.

We can still make gains on water conservation

After analyzing the communities' water conservation measures, and analyzing potential additional measures, the project found that even communities that have been engaged in water conservation for some time can still make additional gains on water conservation. The Region of Waterloo, for example, has been actively implementing water conservation measures since at least 1985 and has made dramatic progress. Nevertheless, in their benefit/cost analysis, 11 of the 17 measures examined had a benefit/cost ratio greater than one, meaning project benefits outweighed costs. If all 11 measures were to be implemented, the projected water savings between 2015-2020 would be approximately 3,223.81 megalitres.

Analysis in Oakland County, MI – which includes Lyon Township, Commerce Township and SW Oakland Township – reveals high peak season water use. Piloting outdoor water efficiency programs would be a start to helping reduce this peak water use.

Many municipalities in the Great Lakes – St. Lawrence region have implemented water conservation measures to some degree. The Region of Waterloo example is encouraging because it emphasizes the fact that water conservation can and should continue even after targets or milestones have been met. Ever increasing water conservation should become normal behavior.

The Region of Waterloo is exploring many next generation water conservation efforts, like greywater and rainwater harvesting systems that are plumbed for indoor non-potable use and new technology, while also relying on fundamental water conservation efforts like education-focused programs and a toilet flapper replacement program.

There are barriers to progress

Communities are facing a number of obstacles as they work to better manage water and implement water conservation and green infrastructure measures. These barriers and the solutions to them include:

1. **Multiple and often siloed municipal departments are involved in water supply, wastewater and stormwater management processes:** A more centralized, more integrated approach to water in the municipality is necessary. All the departments that touch water operations should be communicating with one another regularly and planning together so that capital projects can include elements that have positive impacts on the entire water system.

2. **Green infrastructure usually does not move beyond one-off pilot projects to impactful system-based installations:** Cities need tools, resources, best practices and financial support to break out of the one-off green infrastructure project cycle. Effective green infrastructure needs to be located in the place of greatest need (chronic flooding, for instance), be of the appropriate scale, and integrated into an overall green-infrastructure plan.

3. **The benefits of water conservation in conjunction with green infrastructure are often not considered:** Too often water conservation is seen as contributing only to water use needs and green infrastructure only to stormwater management needs. A more integrated approach to water highlights that water conservation and green infrastructure can work together toward the same goals and at the same time help restore the natural water cycle. For example, green-infrastructure projects can return water directly to the recharge area, thus helping increase the water supply. Likewise, decreased water use means less demand on the wastewater treatment plants.

4. **There is a lack of sustainable funding for water conservation and green infrastructure efforts:** Much like the one-off green infrastructure pilot project cycle, funding for green infrastructure and water conservation in the United States and Canada has been fractured and of the one-off nature. Municipalities need support from their federal, state and provincial partners to implement water conservation/efficiency and green infrastructure measures, and there needs to be a sustainable funding source to support these efforts.

5. **There is a lack of trust in water conservation and green infrastructure:** Municipalities need to gain confidence that water conservation and green infrastructure and water conservation measures, working with existing gray infrastructure systems, can have a substantial impact on avoiding the water-related problems that municipalities confront. At the same time, the environment will be restored to a more natural system, and municipalities will find a return on investment through energy savings, deferred or avoided capital infrastructure expenditures, and avoided costs to address water-related crises.

It is imperative that the Great Lakes region mobilize and work to identify and implement solutions to these barriers in order to restore the natural water cycle and more sustainably manage the Great Lakes – St. Lawrence River system.

The Greater Lakes: Reconnecting the Great Lakes Water Cycle project is ongoing. We encourage municipalities and other stakeholders to continue checking back for updates at http://glc.org/projects/water-resources/greater-lakes. Join our email list to be notified of updates and events: http://www.great-lakes.net/forms/subscribe.html?listname=greaterlakes.

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